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ECOLOGY, MATING AND NESTING OF *TACHYPOMPILUS FERRUGINEUS NIGRESCENS* (HYMENOPTERA: POMPILIDAE)Frank E. Kurczewski¹**ABSTRACT**

An aggregation of *Tachypompilus ferrugineus nigrescens* was studied during mid-summer 1988 in Syracuse, NY. Wasp activity was focused on a 2 m high cemetery monument near a gravelly roadway. Males perched on the stone, chased one another and pursued incoming females in flight. Details of mating are described. Both sexes spent the night and periods of inclement weather inside a narrow crevice near the base of the monument. Females flew around the monument, landed frequently and made exploratory walks inside of the crevice. They were observed searching for prey and transporting paralyzed spiders backward on the ground. Seven conical or concave depressions (cells) were located inside of the crevice in loosened soil, powdered mortar and debris. A paralyzed spider was positioned in each depression, ventral side up, and a wasp's egg was affixed laterally to the base of the prey's abdomen. Prey spiders comprised moderately large *Lycosa helluo* and *L. rabida* (Lycosidae). Closure of the nest is described.

The genus *Tachypompilus* is widespread in tropical and subtropical parts of the world. Only two species, *T. ferrugineus* (Say) and *T. unicolor* (Banks), inhabit the Nearctic region north of Mexico (Krombein 1979). *T. unicolor* is found in the western United States, and *T. ferrugineus* has several color forms in the southwestern and eastern U.S. (Evans 1950, Wasbauer and Kimsey 1985). *T. f. ferrugineus* (Say) is a relatively common, erythritic form found east of the Rocky Mountains and south of New York State, while *T. ferrugineus nigrescens* (Banks) is a more melanic form inhabiting the Carolinian and Alleghanian regions (Evans 1950). Both Evans (1950) and Kurczewski and Kurczewski (1963) have questioned the validity of subspecific designations for the several color forms of *T. ferrugineus*.

Nearctic species of *Tachypompilus* nest near or beneath walls, stone piles and buildings, or in crevices and holes in the ground (Evans and Yoshimoto 1962). *T. f. ferrugineus* has been observed nesting among the crevices of a stone wall and in an old log smoke-house (Rau and Rau 1918), and near the concrete steps of a building (Evans and Yoshimoto 1962). Strandtmann (1953) noted *T. ferrugineus annexus* (Banks) [as *T. ferrugineus burrus* (Cresson)] nesting beneath houses in loose, dry soil. Nothing has been reported on the nesting habitat of *T. ferrugineus nigrescens*.

Prey capture in *T. ferrugineus* is rather selective and consists of moderately large, wandering spiders of the families Pisauridae, Lycosidae and Ctenidae with a preponderance of *Lycosa* spp. (Krombein 1979, Kurczewski 1981, Wasbauer 1983).

My study of the ecology, mating and nesting of *T. ferrugineus nigrescens* comprised sporadic observations made during mid-summer 1988 on, under and near a 2 m high monument in Oakwood Cemetery, Syracuse, Onondaga County, New York. Four males

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were observed from 23 July to 7 August. They flew around the base of the monument between 1050 and 1741 h (EDT), landed frequently on the stone and then flew away and disappeared for periods of 5–55 min, apparently to feed on flowers. One male was observed taking nectar from flowers of *Daucus carota*. Males perched on the top of the monument with antennae and legs outstretched and wings held flat on the dorsum. They chased one another from such places and pursued incoming females in flight. Both sexes entered and stayed within a crevice near the base of the monument during periods of rainfall and at night. As many as eight wasps (four males, four females) occupied this space simultaneously.

Mating was observed once. A male and a female alighted almost simultaneously in close proximity on one side of the monument near the base. The two wasps walked slowly toward one another, both of them wing scissoring (as opposed to the customary vertical wing flicking of Pompilidae). They approached to within 2 cm of each other, face to face, continued wing scissoring and vibrated their antennae while holding them outstretched. The noticeably smaller male then flew to the rear of the female, mounted her facing in the same direction and assumed a position far back on her abdomen. He grasped the posterior edge of her forewings with his tarsal claws and curved his abdomen beneath hers in order to contact her genitalia. His foretarsi then grasped the sides of her propodeum or first gastral segment and the pair remained still but coupled for 27 sec. The two then separated, the female flew away and the male followed her for a distance of 1.0 m.

Females were observed from 23 July to 19 August. They flew around the base of the monument, landed frequently and periodically walked inside of the 2.5–3.7 cm-wide crevice near the bottom of the stone. They continued to wing flick vertically as they entered the opening. After staying within for 1–18 min, such a wasp exited, paused momentarily and flew away for several minutes, evidently to hunt for prey spiders or obtain nectar from the flowers of *D. carota*. Some females investigated the entire width of this basal crevice, possibly for use as a future nesting site. Such wasps either wing flicked or held the wings flat on the dorsum during these exploratory walks. Other females landed, examined the crevice and flew away without entering, perhaps a form of localization or orientation to the monument.

Females were observed searching for prey spiders among leaf litter and overgrown vegetation bordering a gravelly road leading through the cemetery. Four wasps were seen between 1142 and 1618 h, transporting paralyzed spiders across a lawn and toward the monument described above. Each wasp grasped the spider with the mandibles by a palpus or chelicera and walked backwards on the ground. At intervals, some of the females paused, released the grasp of the spider, cleaned their antennae with the strigilis of the forelegs, rubbed the hindlegs together, rubbed them over the end of the abdomen, grasped the spider as described and resumed transport. Manipulation of the prey within the crevice at the base of the monument could not be observed because of the narrow confines and darkness within the opening. Some females appeared periodically inside of the orifice several minutes after entering with prey and began raking in loosened soil and debris, using the forelegs alternately. Such wasps also used the mandibles to pull in pebbles, twigs and grass blades which comprised final components of the fill.

Seven cells were located in loosened soil, powdered mortar and debris inside of the crevice at the base of the monument. The soil, mortar and debris had evidently accumulated there due to weathering, wind action and human activities such as grass mowing. The cells comprised conical or concave depressions, 2.0–2.5 cm deep and 3.5–4.5 cm in diameter at the top edge (It was necessary to use a flashlight and a 30 cm-long forceps in order to obtain cell dimensions and remove prey from the depressions). Depressions containing paralyzed spiders were located as close together as 4 cm and as far apart as 21 cm. It is not known whether cells in close proximity were made by the same wasp or by two or more females. After oviposition, the depression was filled with soil and debris almost to the top of the crevice. The paralyzed spider was positioned inside of the depression, ventral side upward, and the extent of the paralysis appeared to be permanent. The wasp's egg, 0.3–0.4 cm long, had been affixed laterally to the base

of the spider's abdomen. Four such eggs had been attached to the left and three to the right sides of the abdomens. The seven spiders, all Lycosidae, were identified as follows: *Lycosa helluo* Walckenaer, three subadult, two adult ♀; *Lycosa rabida* Walckenaer, two subadult ♀. They weighed (wet) 179–501 mg (\bar{x} = 302).

DISCUSSION

Tachypompilus ferrugineus is a wide ranging species with several erythritic and melanic color forms in the United States and Mexico (Evans 1950, 1966). *T. ferrugineus nigrescens* is a melanic form that inhabits the northeastern U.S. This form has only a single flight period annually in midsummer; in the southern states the nominate subspecies flies during a several months' period and probably has two or more generations per year. Nothing reported herein delineates any difference in nesting behavior between *T. ferrugineus nigrescens* and the nominate subspecies; thus subspecific designations appear to have no biological validity. The species has the unusual habit of nesting in, under and around buildings, rock piles, stone walls and crevices (Rau and Rau 1918, Strandtmann 1953, Evans and Yoshimoto 1962). Nesting in such sheltered situations is seemingly related to the construction and use of a simple concavity or depression as a nest. (Most genera of Pompilidae build a tubular subterranean burrow or mud nest or nest inside of a plant or wooden structure, e.g., trap-nest [Evans and Yoshimoto 1962, Krombein 1967].)

The conical or concave depression is dug following prey capture and its construction involves use of the mandibles and forelegs for soil removal and abdomen for smoothing the inside of the cavity (Strandtmann 1953). The foretarsus of *T. ferrugineus* contains a lateral series of long rake-spines which are used during soil removal (Evans 1950). Although the front of the female's head is distinctly tuberculate above the antennal bases (Evans 1950), no digging or closing function has been attributed to these structures.

Prey transport, during which the wasp grasps the spider's palpus or chelicera and walks backward on the ground, is a highly unusual method among the Pompilidae and may characterize all species of *Tachypompilus* (see Rau 1922, Evans and Yoshimoto 1962). Oviposition, during which the wasp positions itself beneath the spider, as figured and described by Strandtmann (1953) for *T. ferrugineus*, is characteristic behavior not only for species of *Tachypompilus* but also for other genera of Pompilidae. I have observed *Anoplius* spp. positioned so during oviposition when exposed within their cells. The use of the forelegs and abdomen during nest closure is customary behavior in many species of spider wasps, but the placement of debris on the fill, using the mandibles, as seen in *T. ferrugineus*, is associated only with certain genera of pompilids, e.g., *Anmosphe*, *Poecilopompilus*, *Episyron* (Bugbee 1939, Evans and Yoshimoto 1962, Kurczewski 1981, Kurczewski and Spofford 1986). The placement of the paralyzed spider in the cell in a ventral side up position, as noted in *T. ferrugineus*, is not unique and has been reported for other species of Pompilidae (Evans and Yoshimoto 1962, Kurczewski and Spofford 1986, Kurczewski, et al. 1987). The affixation site of the egg of *T. ferrugineus*, i.e., laterally on the base of the spider's abdomen, appears to represent genus-typical behavior (Strandtmann 1953, Evans and Yoshimoto 1962).

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